THE PENNY MAGAZINE

OF THE

Society for the Diffusion of Useful Knowledge.

559.] PUBLISHED EVERY SATURDAY. [DECEMBER 19, 1840.

HORSE ARMOURY IN THE TOWER.—XVII.

[Concluded from No. 557.]

[James II.]

WE now resume our history of armour in England. From the time of James I., the improvements made in the science of war, the new regulations adopted in the management of large bodies of troops, and the rapidly increasing use of fire-arms, caused many of the old weapons to be disused, and with them the necessity for various cumbrous pieces of defensive armour was every day becoming more remote. On the accession of Charles I., armour was very sparingly employed, only the lanciers and heavy-horse wearing more than back and breast pieces, and the armour worn by these did not descend below the knee. The pikemen and musketeers wore helmets, and back and breast pieces with tassets, while some regiments of cavalry were only protected by a cuirass over a buff coat.

This last was a favourite dress with many noblemen and officers, and the troops thus habited acquired the name of cuirassiers. Dragoons, first raised in France in the year 1600 by the Marshal de Brisac, were now also a regular part of the English army, and were habited in a buff coat with deep skirts, and an open head-piece with *cheeks*, that is, with iron pieces hanging down by the sides of the face. The cavalry consisted of four corps—the lanciers, the cuirassiers, the harquebusiers, and the dragoons. The lancier was habited in a close casque or head-piece, gorget, breast and back pieces, with pauldrons, vambraces, gauntlets, and tassets; and armed with a sword, two pistols, and a lance eighteen feet long. The cuirassier was habited as we have described him, and carried pistols at his saddle-bow. The harquebusier was dressed similarly to the cuirassier, but carried a harquebuse, two feet and a half long, hung to the belt by a swivel, and pistols. The dragoons bore the short musket called a dragon, and afterwards the caliver, a still lighter piece.

It was about this time that the modern firelock was introduced, said to have been first used by a set of Dutch marauders termed *snaphans*, or poultry-stealers, from whom the name of *snaphaunce*, at first given to this kind of fire-arms, appears to have been derived. They could not afford to purchase the expensive wheel-lock, and the necessity of substituting something in the stead of the match (which frequently led to their betrayal), induced them to adopt a flint for the pyrite, and an upright moveable furrowed piece of steel in lieu of the wheel; the cover of the pan being pushed back, the piece of steel was brought to stand over it, and the spark elicited as at present.

The "Sweyne's feather," called also by the names of the "hog's bristle" and the "Swedish feather" (having

been probably a Swedish invention), was much used during the civil wars. This instrument of offence was in the shape of a long rapier blade, and was made to fix on to the end of the musket, after the piece had been discharged, so that it might be employed as a pike.

Charles I., soon after his accession, caused a survey to be taken of all the arms and armour preserved in the Tower of London, and in the several forts and magazines throughout the kingdom; and in the seventh year of his reign he appointed commissions to proceed over the kingdom in order to prove and put in repair the arms of the militia throughout England, fixing their charges for the repairs of particular portions of armour and weapons. In the reign of Charles II. the military costume differed but little from that of the times of Charles I. and the Commonwealth, except that armour was still less used and the remainder of the dress rendered more ornamental with lace and embroidery. The helmet, with the corslet or cuirass, or the gorget alone, worn over a buff coat, formed the total defence of steel worn by the officers. The principal improvement in arms of this period was the bayonet, which, invented at Bayonne, whence its name, was speedily adopted into most European countries. The bayonet was sometimes flat, sometimes three-edged, and was furnished with a wooden hilt like a dagger, by which it was screwed or merely stuck into the muzzle of the gun. It was not fixed to the gun by the English in the manner in which they are now fastened until after the time of William III. In one of William III.'s campaigns in Flanders, a French regiment advanced against the British 25th with bayonets fixed by a ring over the muzzle. Lieutenant-Colonel Maxwell ordered his men to screw their bayonets into the muzzles of their muskets to receive the French, who he expected were coming to the charge, when the latter suddenly threw in a heavy fire to the astonishment of the British, who could not understand how it was possible to fire with fixed bayonets. They however recovered themselves, charged, and drove the enemy out of the line. This improvement suggested the socket bayonet, which was shortly after invented, and displaced entirely the pike.

In the reign of James II. the helmet was almost wholly laid aside, the full-flowing wig falling somewhat incongruously over the red coat and steel cuirass. The carabineers were embodied in this reign, and were formed into regiments in the reign of William III. They wore breast and back plates, and iron skull-caps sewn in the crowns of their hats. They were armed with swords, and carried pistols in holsters, the carbine slung behind by a belt and swivel. They also wore high black-leathern close-fitting boots reaching to the thigh, in lieu of the buff-leather boots of the Charleses, with their wide-spreading tops.

The figure of James II. in the Tower exhibits the costume of the period, being habited in a coat with the sleeves turned up to show the delicate lawn sleeves, the breast protected by the corslet, and the head by a round steel cap, with a guard or mask for the face. The curious mixture of civil and military costume in this dress must have given a very ludicrous appearance to the troops thus habited.

The incertitude and wayward course of this unfortunate monarch's destiny has caused him to be styled by one of our biographers (taking the metaphor from a print in which he is represented, when young, as playing at tennis) *the tennis-ball of fortune*. "If we take a cursory view of his life," says Grainger, "we shall find that he was seldom or never at rest. Before the death of his father, he was continually hurried to different parts of the kingdom, according to the various fortunes of that prince. After the death of Charles, we see him in Holland, France, Germany, and other countries: now he is an officer in the French army; then a commander in the English fleet. When his brother was in possession of the throne, he was tossed about by faction, and soon after he took possession of it himself, he was driven to France, and thence, by the impulse of Louis XIV., to venture his last stage in Ireland. He was at length thrown into a state prison* at St. Germain's, where he ended his restless life." He abdicated the throne in 1689, and died in September, 1701.

With James II. the series of figures in the Horse Armoury intended to illustrate the progress of armour and military costume in England is brought to a close, and it would be unnecessary for us to pursue the subject further. We have endeavoured to furnish in some degree the explanations which those figures require, and in so doing have attempted to enliven the details of dress and distinctions of armour by glancing occasionally at the characters and actions of the personages supposed to be represented, and by seeking to throw ourselves into the society of their compeers, so as to catch a glimpse at the institutions, manners, customs, and mode of thinking of ages long gone by.

DOMESTIC CHEMISTRY.—No. XIII.

Substitutes for Wheaten Bread.

The quality of bread met with in the large towns of England is generally wheaten, more or less fine according to the admixture of bran with the pure wheat flour. In country places, however, as also in foreign lands, many descriptions of bread are made which merit a brief notice from us.

The inquiries of practical chemists into the comparative nutritive qualities of different kinds of grain have shown that wheat possesses the largest proportion of nutritive matter, but that other kinds are also capable of forming very wholesome bread. Household bread and brown bread, though deemed of inferior quality to wheaten, are still made from wheat flour mixed more or less with bran. The Scotch peasantry, until a comparatively recent period, ate very little wheaten bread. They used to mix a peck of oatmeal with an ounce of salt, and make it into a stiff dough with water, then form it into flat cakes, and afterwards bake it. These oaten cakes, and a somewhat similar kind made from barley, were the substitutes for leavened or fermented bread.

The Cornish miners ate bread made almost wholly of barley instead of wheat. In some parts of the north, peas-meal mixed with oatmeal has occasionally formed the material of bread. Parmentier, the French chemist, proved that potatoes, turnips, horse-chesnuts, briony-root, and other plants were capable of yielding a meal which might be made into bread more or less wholesome. In some cases he cut potatoes or turnips into slices, dried them thoroughly, pounded them, and then mixed them with grain flour; in other cases, the potatoes or turnips were boiled, mashed, and in that state mixed with the flour. A large portion of the bread used in America is made of one-half maize or Indian corn and one-half barley, with a leaven of wheat. One measure of rice with two of barley afford a wholesome bread, as do equal weights of barley and potato pulp, or equal weights of wheat and rye. Grain of rice, the pith of the sago-tree, the root of the mandioc, are all formed in various ways into bread in Eastern countries.

From these details it appears that many vegetable substances are susceptible of conversion into a material for bread more or less salubrious, and it is an object of prominent importance to increase this list, since it is not in human power to command at all times a plentiful return for the labour which the husbandman bestows on his field of corn. The woody parts of trees are obviously the most extended and bulky, and it becomes an object of no small interest to inquire whether wood contains any nutritious principles.

* He himself had been heard to compare the palace of St. Germain's to a prison.

There are two circumstances whereby wood is rendered unfit for food, namely, the foreign matters always mixed with woody fibre, and the compact aggregation of the fibre itself. The former of these obstacles may be overcome by rejecting such woods as naturally contain a great quantity of foreign matter, as the fir on account of its resin, and the oak on account of its tannin, and by removing everything that water can dissolve from the woods chosen. The kinds of wood best answering this description are the birch and the beech.

An attempt to render wood alimentary has been made with considerable success by Professor Autenrieth, of Tübingen. He found it necessary to reduce the wood to a state of extremely minute division—not merely into very fine fibres, but to a real powder. The repeated action of the heat of an oven is likewise required, both to fit the wood for being ground, and to produce some internal change which renders it more digestible. The mode of carrying on the successive processes is as follows:—

The wood is first thoroughly stripped of its bark, and then cut transversely into thin slices about an inch in diameter. These slices are beaten to fibres in a pounding-mill, and then mixed with the sawdust which results from the cutting. The woody particles are boiled in a large quantity of water, in order to remove, as far as possible, the harsh and bitter principles it may contain; or else they are subjected for a long time to the action of cold water, by enclosing them in a strong sack, and beating or treading the sack in a rivulet. The wood is next dried by exposure to the sun or to the heat of a fire, and is afterwards ground repeatedly, till it assumes the form of a rough flour.

The wood-flour is then formed into small flat cakes by the addition of water which has been rendered slightly mucilaginous or gummy. Professor Autenrieth employed one ounce of the roots of the common marshmallow, which rendered eighteen quarts of water sufficiently mucilaginous to make four pounds and a half of wood-flour into cakes. The cakes are baked until they are quite dry and of a brownish-yellow colour; after which they are broken up and ground repeatedly, till the flour will pass through a fine bolting-cloth. According to the hardness or softness of the wood must the baking and grinding processes be repeated more or less frequently. When birch is employed, the labour is much shorter than with beech or other woods of a more compact kind.

The flour thus prepared acquires nearly the smell and taste of corn flour, but never presents the same appearance, being never white, but of a yellowish hue. It does not ferment without the addition of some leaven, and in this case sour leaven of corn flour is the best. With this it makes a spongy and perfectly uniform bread, like common brown bread, and, when thoroughly baked, is said to have a better taste than the bread prepared in times of scarcity from bran and husks of corn. The addition of a little wheat flour is recommended to form a wholesome bread in the following manner:—Two pounds of wheat flour and three pounds of sour wheat-leaven are mixed up with a little wood-flour and milk, and allowed to stand for some hours in a moderately warm place to rise or swell. About fifteen pounds of birch-wood-flour and an additional quantity of milk are then kneaded in, and the dough is rolled out into thin cakes. These cakes are allowed to stand for some time to swell, and are then well baked in an oven. Thirty-six pounds of bread may be produced from the ingredients mentioned above.

As a proof that wood-flour is both soluble and nutritious, we may mention that starch is obtained from it in the same way as from wheat flour, which with boiling water forms a thick, tough, tenacious jelly. More decisive proofs have likewise been obtained by experiments on animals. Professor Autenrieth tried its nutritious effects on a young dog. He kept the dog a whole day with only water, and then set before him a gruel of indifferently prepared wood-flour, salt, and water. At first the animal ate very little of it, and in the evening was very weak from having taken so little food. During the night he ate freely of the gruel, and in the morning became lively. He now had as much gruel as he could eat four times a-day, and in the course of a few days appeared perfectly reconciled to his diet. This course was continued for seven days, the dog remaining in health and even appearing to grow.

The Professor next tried the effects of the wood-flour on himself and his family. They used it in the form of gruel, soup, dumplings, and pancakes, all made with as little of any other ingredients as possible, and not only did they suffer no inconvenience from this kind of diet, but they also found it palatable. When formed into bread, as before described, Professor Autenrieth first tried its effects by eating a quarter of a pound of it, with weak coffee, for breakfast. The more bread he ate, the rougher and more unpleasant did it become: his throat became somewhat constringed and his stomach oppressed; so that he felt convinced at the time that its continued use would prove injurious to him. At dinner-time, however, his appetite returned, and he ventured to eat of several kinds of soup made of this flour. Finding no inconvenience from this, he ate another quarter of a pound of bread in the evening, with some milk, and no longer found any repugnance towards it or subsequent oppression. He slept well, and arose in his usual health.

Now, from all these experiments, it appears sufficiently evident that a considerable quantity of nourishment may be obtained, but not without trouble and expense, from several kinds of wood. In times of plenty it would be ridiculous to advocate the introduction of such an article as bread made from wood-flour, except for the purpose of showing what may be done in the season of pressing necessity. But were such a season to arrive, the trouble and expense attending the process would be of very trifling consideration, and the lives of numbers might be saved by the knowledge and application of this mode of obtaining bread.

In some districts of Norway and Sweden the bark of trees is converted into bread, which, from the bitter and astringent principles generally residing in that part of the tree, is far less palatable than bread made from wood-flour. According to Von Buch, the mode of making bark-bread in Lapland is as follows:—When young and vigorous fir-trees are felled, the tree is stripped of all its bark, and all the outer parts peeled away, except an innermost rind, which is extremely soft and white. This is hung up for several days in the air to dry, and is afterwards baked in an oven, then beaten on wooden blocks, and pounded as finely as possible in wooden vessels. The pounded mass is carried to a mill, and ground into a meal something like that of barley or oats. This meal is mixed up with *hexel*, with threshed-out ears of corn, or with a few moss-seeds, and cakes about an inch in thickness are formed of this composition. "Nature," says Von Buch, "receives with reluctance the bitter and contracting food, and the boors endeavour to disguise the taste of it by washing it down with water; but in the beginning of spring, after having lived on this bread a great part of the winter, they become weak and relaxed, and are incessantly tormented with an oppressive shooting and burning about the chest." The Laplanders of Kemi Lappmark are described as using bark in a still more crude form. During the summer they peel off the innermost bark of the fir, divide it into long strips, and hang them in their dwellings for winter store, subsisting meanwhile almost entirely on fish. In winter, when their supply of fish fails, they cut these strips of bark into small pieces, and boil them with water and reindeer tallow for several hours, till in consistency they form a thick kind of broth.

THE CATHEDRAL OF TOLEDO.

[Toledo Cathedral.]

Of the ancient glories of Toledo, the once wealthy and magnificent capital of Spain, how little now remains! The sumptuous palace of the kings of Toledo and of their successors the kings of Castile—the Alcanzar—now forms a sort of house of industry for the poor; the population, from two hundred thousand souls, has dwindled away to scarcely one-eighth of that number; the silk and woollen manufactures, formerly employing, it is said, nearly forty thousand men, have almost if not entirely disappeared; and the narrow, winding, dirty, and half desolate streets show but too clearly that no new elements of social power and prosperity have arisen to compensate for the loss of the old. The famous sword-manufactory still exists, and to a certain extent preserves its original reputation: in almost every other respect, the trade, commerce, and wealth of Toledo are but shadows of what they were. Among the monuments of that former period which still exist to illustrate and confirm its brilliancy, the chief are the Alcanzar before mentioned, and the cathedral which we now proceed to describe.

A church, it appears, occupied the site of the present edifice so long back as the sixth century, and which, at the period of the Moorish conquest of Toledo in 1711, was converted into a mosque. For nearly four hundred years it remained thus appropriated to the Mohammedan worship, but in 1085, Alfonso or Alonso, the first king of Castile, having taken Toledo after a three years' siege, the church was again restored to the Christians, though under circumstances not very honourable to them. Alfonso had guaranteed, by the terms of the capitulation, the use of the church to the Moors, but no sooner had he left the city, than his queen, at the instigation of the Archbishop Bernard, sent a party of soldiers, who drove out the Mussulmans then at their devotions. The edifice was immediately purified, temporary altars erected, and a bell placed in the tower, which, on the following morning, to the surprise of the whole city, was heard summoning the Christians to morning prayer. When Alfonso was informed of these proceedings he was so indignant that he immediately returned to Toledo, and, although the priests advanced to meet him, arrayed in deep mourning, to express their contrition, they were only saved from punishment by the entreaties of the Moors themselves, who, dreading the power of the priests, thus nobly as well as wisely sought to allay their bigoted intolerance: for the same reason they also resigned their past claim to the church. In the early part of the thirteenth century, during the reign of Ferdinand III., king of Castile, called also *Saint* Ferdinand from the admirable qualities he displayed, the edifice was rebuilt and enlarged: the old church was transformed into a stately and magnificent cathedral. The successors of Ferdinand from time to time enriched it with every possible kind of decoration, until the building ultimately assumed the aspect that it at present bears.

"I was not long in Toledo," says Mr. Inglis,* "before visiting the cathedral, which has no rival but that of Seville in its claims to be the greatest and most magnificent of Gothic temples. All the cathedrals I had ever before seen shrunk into insignificance when I entered the cathedral of Toledo." Other travellers speak with equal enthusiasm of it. The dimensions of the interior are as follows: length 408 feet, breadth 206 feet, height of the central nave 160 feet. There are five distinct naves, formed by the walls and by four rows of columns. The latter, which are very massy (those nearest the walls measuring no less than forty-five feet round), are placed at distant intervals, and consist of a pier supporting a shaft or pillar, which is single, and not, as in most Gothic churches, clustered. The magnificent effect of the original plan has been much lessened by the numerous divisions into which the interior has been cut up by the choir, and by the different altars erected in various parts, and, above all, by the "detestable transparente," or screen, erected, at a great expense, in modern times as a mystical representation of the sun striking upon the great altar,

* 'Spain in 1830,' vol. i., p. 384.

which is effected by a miserable contrivance. In spite of these blemishes, however, the edifice is still what Mr. Inglis so emphatically terms it, one of "the greatest and most magnificent of Gothic temples." Its amazing extent, the solidity of the gigantic columns which support the roof, and the beauty and variety of those which surround the choir (one hundred and fifty-six in number), the gorgeous splendour of the painted windows (of which there are no less than sixty-eight), and the decorations thrown with an almost reckless profusion over every part, excite the wonder and admiration of every beholder. And when seen under the circumstances described in the following passage, dull indeed must be the soul in which the cathedral does not raise feelings of a still more lofty and permanent character:—"The last evening I remained in Toledo (we again quote from Mr. Inglis's interesting work), I walked into the cathedral some time after sunset,—it was the latest visit I had made to it: the interior was all wrapped in deep dusk; the lofty aisles stretching darkly beyond, only shown by the solitary lamp burning before the shrine of some inferior saint, its ineffectual light dimly falling athwart the gloom; the painted windows had ceased to throw their gorgeous hues within, but a speckled and faintly coloured gleam fell upon the upper part of the columns. Two candles burnt before the altar major; and in the distance, at the farthest extremity of the church, a bright red blaze flashed across the aisle and between the massive pillars, throwing their broad shadows across the marble-checquered floor of the church: this was the Chapel of the Miraculous Image, lighted up with an infinity of tapers; and the only sound to be heard, save my own footstep, was the distant hum of prayer from the many devotees prostrated before her shrine. Here and there, as I walked through the aisles, I saw a solitary kneeler at the altar of a favourite saint; and at some of the remotest and obscurest spots, a cloaked caballero was waiting for good or for evil."*

The cathedral contains many interesting antiquities. Among various other uncouth figures in the choir, there is one representing the Moorish shepherd who was compelled by Alfonso VIII. to guide him and his army through a previously unknown pass in the Sierra Morena, by which means Alfonso was enabled to fall suddenly upon the Moorish hosts, and gain the bloody battle of Las Navas de Tolosa. Here too are the tombs of four of the old kings of Castile, and the tomb of one of the most illustrious prelates of the see, Cardinal Mendoza. Several of the chapels of the cathedral also contain interesting monuments. In that dedicated to the Virgin, Cardinal Portocarrero is interred, with the deeply expressive epitaph—"Here lies dust, ashes, nothing." In the chapel of St. James we find the magnificently decorated tombs of the ten later kings and queen of Castile, and also of Don Alvar de Luna; the last covered with pompous inscriptions that seem little else than a satire upon that unfortunate nobleman when considered in connection with his fate: raised by the favour of John II. to the highest possible pinnacle of rank and power, he was ultimately left by the same monarch to perish on the scaffold. The ceiling of the vestry is beautifully painted in fresco by Luca Giordano. On one side of the cathedral is a square court enclosed by ranges of columns and a covered cloister. The latter is very large, and of noble proportions; its date is later than the church. On its walls, the two best Spanish painters of the last century, Bayeux and Maella, have traced the history of St. Eugenius and St. Leocadia, the patrons of the cathedral, as well as of other saints famous at Toledo. It is much to be lamented that these beautiful works should be exposed to the open air, and to the premature decay which such a circumstance must produce. In the same place there is a painting, the subject of which is sufficiently disgusting, but which is at the same time admirable for vivacity and general excellence of execution. The story embodies the charge which was so continually raised against the Jews during the middle ages, of crucifying a child, and which, with but slight alteration, we have recently seen revived in Damascus with nearly all the original cruelties. How long this idea has survived the effects of superior enlightenment and a worthier estimation of our fellow-men, may be seen in Spain as well as at Damascus; the child referred to in the above picture was kidnapped, it is said, from the village of Guardia, and even to this hour "the little one of Guardia" is held in the greatest adoration in his native place. The central part of the court forms a delightful garden, planted with odoriferous shrubs and fruit-trees, and having in the centre a fountain. As we have already seen in our recent account of the Mosque of Cordova, the entrance to the Moorish religious temples generally ran through a garden or court of this kind: to them, therefore, Toledo is most probably indebted for this interesting appendage to its cathedral.

Among the curiosities of the cathedral, the chief are the "preciocidades," which cannot be seen without an express order to that effect. Nor will such a precaution seem extraordinary when we perceive the almost incredible value of the things included under that name. The cathedral of Toledo is unquestionably the richest in the world. Our space will only allow us to mention a few of the precious articles here preserved. The mantle and crown placed on a silver figure of the Virgin on particular occasions are the first in point of value. The mantle is of satin, but so completely covered with precious stones that no part of it is visible; we see simply a groundwork of pearls, studded all over with emeralds, rubies, topazes, and diamonds. The crown also, though of pure gold, is entirely concealed by jewels of the largest size and most brilliant character, sapphires, emeralds, rubies, and diamonds, and surmounted by an emerald of extraordinary beauty. On high days, the silver image of the Virgin, wearing the robe and crown, and holding in its arms an infant of solid gold, and adorned with eight hundred jewels, is placed upon a silver throne weighing more than half a ton, and borne upon men's shoulders through the streets. The next in value is the Custodia used for the exposition of the sacrament, which weigh no less than seven thousand ounces, and is entirely formed of silver and gold, studded with jewels. In the centre is a shrine of gold weighing fifty pounds. It is, if possible, however, still more valuable for the workmanship than for the materials, being constructed of very small pieces, which, when screwed together, form a Gothic tower covered with the most exquisite fretwork. There are also images, urns, &c. of pure gold, almost without number, many of them studded with gems. In the urns are contained the relics of the cathedral, which include something of almost every saint in the calendar: that of St. Casilda must not be overlooked, were it only for the legend with which it is connected. San Ildefonso, a distinguished archbishop of the see, having written a work in defence of the immaculacy of the Virgin, St. Mary was so pleased that she sent St. Casilda (thus runs the legend) with a highly complimentary message, which was delivered whilst the archbishop was performing mass in the presence of the king and his court. Ildefonso, to silence all cavillers as to the fact of this visit (for we presume the saint was invisible to all but him), asked the king for the knife he wore at his girdle, and cut off with it a part of St. Casilda's veil. Not satisfied with this, the Virgin subsequently appeared in person to Ildefonso, to express her acknowledgement, and threw over him a garment of heavenly manufacture. The veil and knife are still shown as proofs of the truth of the story, as are also the marks of the Virgin's feet deeply imbedded in the stone where she alighted, but the garment was carried to Oviedo during the Moorish invasions, and has there remained ever since, the inhabitants refusing to give it up. It is even stated that a proposal of

* Inglis's 'Spain,' p. 388.

that nature had once nearly thrown the people of Oviedo into insurrection. The riches of Toledo had a narrow escape during the period of the French occupation. The archbishop had previously conveyed to Cadiz all the portable articles, the rest he could not remove; the French, however, accepted the trifling sum of two thousand two hundred and fifty pounds of silver in lieu of all the immense wealth that was in their grasp. Every article is inventoried and valued in a proper book; and "although," says Mr. Inglis, "my informant did not state to me the precise amount of the whole, he said it exceeded forty millions of ducats, or ten millions sterling of English money!" But we may say in conclusion, with the same writer, "the preciocidades and marbles and porphyries and paintings are not the most interesting features of the cathedral of Toledo: its immensity, its grandeur, are its glories. The lofty and majestic aisles, the massive and far-stretching columns of a temple like this, seem almost to shadow forth the imperishable nature of the religion whose sanctuary they adorn and uphold. The longer we contemplate the vastness and majesty around, the mind is more and more filled with awe, and lifted from the insignificance of life to a sense of the greatness and solemn grandeur of eternity; we are filled with enthusiasm and admiration,—enthusiasm the more lofty because it is mingled with religion; and admiration the more profound, since it is mixed with astonishment that so frail a creature as man should be able to perpetuate his memory for ever."*

ASPHALTUM, OR BITUMEN.—No. II.

THE ECONOMICAL USES OF ASPHALTUM.

In the last article on this subject we described the nature and appearance of large masses of bituminous earth and rock in different places; and we may now consider the modes in which similar substances have been brought into useful application, especially in France.

It is commonly supposed that such an employment of asphalte is altogether modern; but this is not exactly the case. So long ago as the beginning of the last century, great encomiums were passed on a certain asphaltic cement discovered in Neufchatel in France. A little book was published at Paris in 1721, called 'Dissertation sur l'Aspnalte, ou Ciment naturel, découvert dans la comté de Neufchatel;' in which the author, M. d'Eyrings, describes the modes of preparing the cement and of applying it to useful purposes.

The author in his preface says,—"The mine of asphalte, discovered about ten years ago, at Neufchatel, is a treasure for Europe unknown to previous ages; or at least it does not appear that before that time any one had worked it, or that the earth which covers it had been removed." He proceeds to describe this asphalte as a brown, viscous, wax-like substance, emitting an odour something like that of amber; containing an oily liquid in its pores or interstices; and capable of hardening into a durable solid by a certain mode of treatment. "I have seen in Soleure and Neufchatel," he says, "the basins of fountains twelve or fifteen feet in diameter cemented with this asphalte: the stones are as well united as on the first day, and are so perfectly joined that they seem to be one piece; the water is retained as well as in a vase, although exposed to heat, cold, and all the vicissitudes of temperature." M. d'Eyrings proceeds to state that the asphalte must be taken from the rock, broken into small fragments, and finally powdered. Burgundy pitch is then to be melted in a copper or iron cauldron; and when thus melted, the powdered asphalte is to be added by small quantities, and stirred up with a stick. Nine parts of asphalte are to be mixed with one of pitch, and the whole thoroughly melted. The liquid cement is then to be poured into the crevices or openings between stones, and will soon harden into a substance as hard as stone. It appears from this description that he regarded the asphalte rather as a cement than as a substitute for stone; but he conjectures that it might do well, if laid on a substratum of sand, to form terraces and walks, without the intervention of any stones. He mentions the names of several French noblemen who had used the asphalte as a cement for fountains, and speaks with earnestness of the numerous uses of this substance.

We find no mention of this asphaltic rock or mine in subsequent periods; nor was it till about half a century ago that attention seems to have been directed to the extensive use of asphalte in the arts; and even long after that period the subject attracted very little notice. It was, we believe, about 1790 that an accidental circumstance drew the notice of some individuals to the qualities of an asphaltic rock in the south of France, near the banks of the river Rhone. During the removal of some ancient remains of fortification, supposed to be Roman, it was remarked that the stones were cemented together so powerfully that the aid of gunpowder was required to separate them. On examining this cement, it was found to bear a great resemblance to a mass of asphaltic rock in the park of Pyrimont, about five miles from Seyssel. The lower floor of a house near the Rhone in the neighbourhood being damp, it was determined to try whether this asphaltic rock could be melted and applied as a cement to cover it, so as to exclude damp. The attempt appears to have succeeded; and the mineral began to be used for similar purposes among the neighbouring inhabitants. But it does not seem to have been made an object of commercial speculation till about twenty years ago, when a company of persons embarked a certain amount of capital in it. Since that time the property has changed hands, new modes of preparing the cement have been adopted, and the use of the mineral has become extensive in France. The attention of English surveyors and engineers being thus directed to the subject, Mr. Simms, civil engineer, went to France to examine the nature of the mineral, the mode of its preparation, &c.; and from a small pamphlet which he published on the subject in 1838, we obtain a few particulars on these points.

Between Mount Jura and the right bank of the Rhone, not far from the town of Seyssel, the surface of the ground is covered with a sort of bituminous gravel, called *molasse*, the gravel being to a certain extent impregnated with bitumen, and having also veins or fissures filled with this substance. The molasse extends from the banks of the river to the foot of the mountain; and at one particular part a mass of calcareous asphalte, sixteen hundred yards long by six hundred broad, rises up through the middle of the molasse. The calcareous matter of which this rock is formed is whitish on the exterior surface; but the interior is of a deep brown colour, due to a quantity of bituminous matter with which it is impregnated. This asphalte is tolerably equally diffused throughout the mass, but not wholly so; and there is reason to believe that the asphaltic rock forms the substratum on which the *molasse* is situated. If this be the case, the nature of the district may be thus summarily described:—A mass of calcareous rock, impregnated with a certain quantity of bitumen, is covered, except at one part, by a stratum of gravelly soil, still more impregnated with bitumen, the uncovered part being the calcareous rock exposed to view. The calcareous asphalte is found to contain about ten per cent. of pure bitumen, the remainder being carbonate of lime. The bituminous molasse contains from fifteen to eighteen per cent. of bitumen, the remainder being composed of micaceous sand.

In the course of the experiment tried, in order to bring this asphaltic rock into use, it was found that the molasse which surrounds it, or the bitumen contained in the molasse, was useful as a flux to assist in reducing the whole to a fluid state. The compound obtains the name

* Inglis's 'Spain,' p. 397.

of asphaltic mastic; and the mode in which this mastic is made is described as follows:—the materials are conveyed to the spot where they are to be used, and there melted: the asphaltic rock is misshapen masses of about a cubic foot contents, and the bitumen in barrels. The asphalte is merely hewn from the rock in blocks, which are transported to the place where they are to be used: the bituminous matter from the molasse is broken into pieces about as large as an egg; and after being put into boiling water, the particles which rise to the surface are purified by boiling for twenty-four hours, and are then barrelled. The masses are placed in a temporary furnace, about ten feet long and three broad, consisting of a cast-iron trough set in brick-work. A brisk fire being made beneath the trough, the asphalte, as it becomes heated, falls to pieces, and is easily reduced to powder by pounding with a heavy mallet.

The melting furnaces, or cauldrons, are heated by fires underneath, and into each cauldron about fourteen pounds of bitumen are placed. When this is dissolved, the powdered asphalte is added by degrees, till nearly two hundred pounds weight of it have been introduced. These ingredients are well mixed and stirred up, in order to prevent them from adhering to the cauldron; and when the composition has attained nearly to a liquid state, which occurs in about an hour and a half, a small quantity of fine, clean, heated gravel is introduced. The whole is again stirred, and kept heated till it slightly boils, emits a white smoke, and acquires a consistency rather more liquid than that of treacle. It is then fit for use, either to be poured into moulds, or used in any other manner. It will be seen that this mode of proceeding does not greatly differ from that followed by D'Eyrings a hundred and twenty years ago, except in the employment of molasse bitumen instead of Burgundy pitch.

The extent to which this asphaltic mastic, as it has been termed, has been used in France, is considerable. Paris contains many more public squares, or 'places,' than London; and the surfaces of these squares have been in many instances covered with this mastic. The Place de la Concorde, in the midst of which is the Luxor obelisk, is described by Mr. Simms as being covered in a very beautiful manner. A substratum of lime, sand, and mortar, about three inches thick, was laid over the surface of the ground, and well smoothed at the top. When this was dry, a mosaic pattern was formed by iron bars, about half an inch thick, and into these compartments the liquid mastic was poured. The design consisted of large squares alternately black and white, each square having a circular disk in the centre, of the contrary colour to the square itself. This colour was produced by sprinkling black or white gravel over the surface of the mastic before it lost its adhesiveness, and stamping it into the mastic by means of flat boards attached to handles. When hardened, the whole had the appearance of a black and white chequered granite paving.

Another extensive application of the mastic in Paris is at the long parade on the north side of the palace and gardens of the Tuileries. The footpaths on the Pont Royal, on the Pont de Carousel, on the Boulevards des Italiens, on some of the abattoirs (slaughter-houses), and others, have been formed of this material.

Another employment of the mastic seems to have been for roofing. This is said to have been adopted in many of the fortifications, barracks, arsenals, &c. at Douay, Vincennes, Besançon, Lyon, Grenoble, Peronne, and other places in France. In some of these cases the roof was thus constructed:—Fir laths were laid on the rafters, and on these square tiles of burnt clay, cemented with asphaltic mastic. Canvas was stretched all over the tiles, and properly secured; and on this a layer, rather less than half an inch in thickness, of the mastic was laid; lastly, a fine stratum of sifted gravel was laid on the mastic, and beaten into it while moist.

As a flooring for apartments it has also been used; and for this purpose a mosaic work of a singular kind has been produced. A flat flooring of smooth plaster being formed, any required pattern or device is drawn upon it, and then a thin coating of glue or size is laid on. While this is yet wet and adhesive, small pebbles, of various colours, and flattened on one side, are disposed according to the pattern, and made to adhere slightly to the glue. An iron border is then placed round the collection of pebbles, of a square, circular, or any other shape; and into the moulds thus formed, the melted mastic is poured. When this is cold, the cake or slab is taken up, and its under surface presents a mosaic appearance, the pebbles being interspersed amidst the bitumen, and firmly adhesive to it. These slabs can then be laid down side by side, and cemented together by mastic being poured between them.

Such is a brief sketch of the various modes in which the asphaltic mastic has been employed in France, to which we may add another, that of a cement for securing stones together in the manner of mortar. It is not surprising that the attention of engineers and surveyors in England should be drawn to this matter, considering how important the process of water-proof cementation is in civil engineering. Whoever has looked into the public journals within the last two or three years, will have met with many accounts of the employment of asphalte, or bitumen, as a material for roads. In some cases the material has been derived from Seyssel, in others from other quarters: in some the kind and the proportion of the rocky matter combined with the pure bitumen have been different from others: some of the applications have fully answered the end expected; while others have, from various causes, partially or wholly failed. Into these matters it is not our purpose to enter; the subject has now become one of fair public speculation, and as such it will stand upon its own merits, whether they be many or few. Our object has been to describe the class of bodies to which asphalte belongs, the particular variety which yields the asphaltic mastic, the position and condition in which it is found on the earth's surface, the mode of preparing it for use, and the principal modes in which it has been employed on that country where it has been most used. How far asphaltic substances may be successfully applied in the arts, whether as a material for roads and floors, a covering for roofs, a cement for joinings, or in any other capacity, is a matter for experience and enterprise alone to determine; and practical men will be pretty sure to arrive at the truth by comparing it with other substances employed for similar purposes.

EDIBLE PRODUCTIONS OF THE NORTH AMERICAN FORESTS.

[From a Correspondent.]

In speaking of the North American forests, I refer only to that portion of them connected with the British Colonies there,—or to that section of the United States bordering upon them, extending southward to something below the fortieth degree of north latitude, and where a milder climate works a wonderful change in the various productions of the soil. But in treating of the edible productions of this portion of the American wilderness, I must be understood as including only the wild fruits of the forest and the scanty vegetable productions of the swamps and marshes (for within the limits of this region of country there are scarcely any upland prairies to be met with); and such being the case, the view of the subject will be confined within comparatively narrow limits; for the great Western wildernesses are nearly as barren as the deserts of the East.

In some of the swamps and marshes of the unsettled country bordering on Lake Superior, and still farther to the west,—and, indeed, in some of the less remote and better known parts of Upper Canada,—a species of wild rice has long been known. This plant, like the other species of rice, delights to grow in moist situations; and as these swamps

are never dried up, or parched with the summer droughts, no artificial irrigation is necessary, and if it were so, they would not receive it; for notwithstanding most of the Indians immediately connected with the rice-swamps make use of it more or less, they do not appear to value it so much as to cause them to feel disposed to go far to procure it. Most of the swamps where this wild rice grows are wholly impassable without the assistance of some sort of small craft, and none are better adapted for such a purpose than the small light canoes of the Indians, which they push through the long grass and wild rice with poles, it being next to impossible to use oars or paddles in such situations. At the period of gathering the wild rice, a curious scene sometimes presents itself,—several scores of small canoes, each manned (if the expression may be allowed) by a couple of squaws (female Indians), may be seen poling their way along a level plain, which at a distance has no appearance of water, towards the place where the rice is most abundant. When there is little difficulty in navigating the rice-grounds, and the rice is pretty abundant, a canoe will return home at the end of the day with four or five quarts of rice, in an unhusked condition of course; so that if the parties were anxious to lay in a stock for the winter, in two or three weeks they would be able to do so. This however is no part of the Indian character,—the laying up a stock of provisions of any sort is rarely attempted. But if by accident rather than design the wigwam of an Indian becomes stored with more than an ordinary supply of provisions of any sort,—he becomes wasteful and extravagant, and never once thinks of replenishing his stock so long as anything remains.

The usual Indian method of preparing the wild rice is that of boiling it in their rude earthen pots, after it has been previously bruised in a hollow piece of wood substituted for a mortar; and then mixing therein a little bear's grease, or fat of some other kind, a mess is formed of which some of the tribes of Indians appear to be very fond. As the liquor continues to boil, the husks of the rice rise to the surface, which being skimmed off from time to time, but few of them are found remaining in it when the dish is ready. The persons resident at the fur-stations through the long winters are commonly glad to get a supply of wild rice from the Indians they engage to hunt for them, for it often happens that if they fail in procuring a little of this article, they will have to pass the whole winter season without any vegetable food whatever. And they experience little difficulty in achieving their object when rice is found in any of the neighbouring swamps, for a few glasses of strong spirits, bestowed upon some of the chiefs or leading men in tribe, will procure them what they desire. It is hardly probable that this species of rice will ever become a matter of consideration longer than the country remains in an uncultivated and wild state, for in the vicinity of some of the settlements to the west of Toronto, the capital of Upper Canada, where it grows to some extent, it is scarcely ever gathered, for it certainly is but a poor substitute for wheat, rye, or barley, or even oats, millet, or buckwheat.

Probably the most valuable of the various sorts of wild fruit found in these regions is the cranberry, for it is not only esteemed by the people of the country, but is so well liked that it will bear the cost of exporting to distant towns and cities, and even to foreign countries. Cranberries, like wild rice, grow in boggy or swampy situations, but not where there is an equal depth of water. This small fruit is found, in greater or less quantities, in all our North American colonies,—and it seems to be found only in the colder regions of the earth. But it is not invariably found in the more regular bogs, for although it delights in moisture, it sometimes grows on small hillocks that are covered with a sort of spongy moss. Among the numerous swamps where these berries are found, that extensive and well known one in the Niagara district, Upper Canada, is called Cranberry Swamp, evidently from its abounding in these berries. This swamp or marsh commences near Grand River on the west, and extends eastward nearly to the Chippewa, a distance of nearly thirty miles. Many of the squaws and children of the Indians (the Six Nations being settled along Grand River), as well as the white population from the settlements in its vicinity, repair hither in the autumn to gather cranberries, which, for the most part, they dispose of to the nearest storekeepers, who enclose them in casks and send them off to the Quebec and Montreal markets. In many places the ground is so boggy, that the parties have to provide themselves with light thin boards to stand upon; each individual requiring two—one to stand upon while he pushes the other forward; and yet, in spite of such precautions, few escape being up to their knees or ankles in mud and water. When gathered in small quantities, they are usually picked by hand,—but small rakes, with the teeth set very close together, are sometimes employed where the parties make a regular business of it.

In these forests there is not, generally, much or valuable fruit; but that seems to be the case in all uninhabited countries possessing a cold climate. Of grasses there are a few varieties—none of them, however, even of a tolerable quality; and one occasionally meets with grape-vines which climb the tallest forest-trees, and a single vine will sometimes extend its tendrels over five or six such trees that probably grow two or three rods asunder. Of wild cherries there are several sorts, principally black ones however; but, like the wild plums, of which there are both white and purple varieties, there is not one that is much sought after or greatly esteemed, neither are those of the persimon and the service-tree, which are both common to most parts of the country. Crabs and wild apples are found in many of the valleys, but, with the exception of the Virginia crab, they are held in no repute. There is also a small wild fruit called the prickly pear, which, as the country becomes settled, is often gathered and made into a preserve that is much esteemed in America; but the Americans are noted for their fondness for preserves and sweetmeats, and they consequently are in the habit of preserving many indifferent sorts of wild fruit, which they allege make very good preserves. Besides the wild fruits already enumerated, there are two sorts of raspberries—the red and the purple, growing very abundantly in many places; and bramble-berries of a very superior quality compared to those of our own island. The strawberry too grows wild in many situations, which, with the raspberries, are among the most esteemed of this class of wild fruits.

But little remains to be added upon this head; for, excepting the various kinds of nuts that are produced in great abundance in most parts of the forest, little or nothing that can with any propriety be considered edible remains to be spoken of. The nuts are found according to the nature of the timber that predominates; and what are called pine-districts are nearly destitute of nuts of any description. The hickory nuts—those called the shell-bark—are accounted the best the woods yield, although some persons give a preference to chestnuts, of which some parts of the forests furnish vast quantities. The hickory-nut is a good deal like the walnut, but with a harder shell; and the nut commonly known by the name of butter-nut also resembles the English walnut, but is not of so good a quality. Besides these, there are two or three varieties of hazel-nuts, none of which are much sought after. In some sections of the country beech-nuts are uncommonly abundant, and one sort is larger than the produce of our beech-trees: but these, and acorns, which in some places grow in large quantities, are properly the food of the wild animals of the wilderness, or of the swine that the white people introduce along with them as they make inroads among the forest-trees.

Whittington's Cat.—The fable of the cat, by which Whittington is much better known than by his generosity to Henry V., is, however, borrowed from the East. Sir William Gore Ouseley, in his Travels, speaking of the origin of the name of an island in the Persian Gulf, relates, on the authority of a Persian MS., that in the tenth century, one Keis, the son of a poor widow in Siráf, embarked for India, with his sole property, a cat: "There he fortunately arrived at a time when the palace was so infested by mice or rats, that they invaded the king's food, and persons were employed to drive them from the royal banquet. Keis produced his cat, the noxious vermin soon disappeared, and magnificent rewards were bestowed on the adventurer of Siráf, who returned to that city, and afterwards, with his mother and brothers, settled in the island, which, from him, has been denominated *Keis*, or, according to the Persians, *Keish*."—*Relics of Literature.*

*** The Office of the Society for the Diffusion of Useful Knowledge is at 59, Lincoln's Inn Fields.

LONDON: CHARLES KNIGHT & CO., 22, LUDGATE STREET.
Printed by William Clowes and Sons, Stamford Street.